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Affect Grid: A Single-Item Scale of Pleasure and Arousal

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This article introduces a single-item scale, the Affect Grid, designed as a quick means of assessing affect along the dimensions of pleasure–displeasure and arousal–sleepiness. The Affect Grid is potentially suitable for any study that requires judgments about affect of either a descriptive or a subjective kind. The scale was shown to have adequate reliability, convergent validity, and discriminant validity in 4 studies in which college students used the Affect Grid to describe (a) their current mood, (b) the meaning of emotion-related words, and (c) the feelings conveyed by facial expressions. Other studies are cited to illustrate the potential uses of the Affect Grid as a measure of mood.

In this article, we introduce the Affect Grid, a scale designed as a quick means of assessing affect along the dimensions of pleasure–displeasure and arousal–sleepiness. The Affect Grid is potentially suitable for any study that requires judgments about affect of either a descriptive or a subjective kind.

The Affect Grid is a single-item scale. Our aim was for an instrument that would be short and easy to fill out and that could, therefore, be used rapidly and repeatedly. Currently available scales of affect are multiple-item checklists or questionnaires that are too time-consuming or too distracting for some purposes. In particular, they do not lend themselves to continuous or quickly repeated observation. They are awkward in dealing with the rapid fluctuations of affect that occur, for example, in response to music, or for all we know, to many everyday emotion-laden events. In repeated-measures designs, subjects tiring of the same checklist may eventually become less conscientious or, in longitudinal studies, drop out of the study. Researchers who have wanted something quick and simple have sometimes resorted to homespun measures—with resulting uncertainty as to precisely what is being measured and how well.

The Affect Grid is shown in Figure 1. The subject is asked to take several minutes beforehand to learn precisely how to use it. General instructions for this purpose are given in the Appendix.[1] Once the subject understands these general instructions, he or she can then be given the Affect Grid together with whatever specific instructions are appropriate, such as "Please rate your reaction to each stimulus as it occurs," "Please rate your mood as it is right now," and so on. The subject places a single mark somewhere within the grid. The pleasure score (P), which ranges from 1 to 9, is the number of the column checked, counting from the left. The arousal score (A), which also ranges from 1 to 9, is the number of the row checked, counting from the bottom.

Theoretical Assumptions

The Affect Grid was designed to record judgments about single instances of affect. Examples would be judgments about current mood, the feeling expressed by a single facial gesture, or the feeling expressed by a single word. For the purposes of this article, we leave aside the complex issues involved in the measurement of aggregates of affective experiences, such as one's feelings over an extended period of time (see Diener & Emmons, 1984; Diener, Larsen, Levine, & Emmons, 1985; and Warr, Barter, & Brownbridge, 1983, for discussions of some of these issues, including such additional variables as the frequency and average intensity of affect).

The Affect Grid was designed to assess two dimensions of affect: pleasure–displeasure and arousal–sleepiness. We do not assume that pleasure and arousal are all there are to affect, but there is good reason to emphasize these two. The concept of pleasure has emerged in too many contexts for it to be ignored in any description of affect. In the fourth century B.C., Epicurus was already describing pleasure as "the beginning and root of all good" (as quoted by B. Russell, 1946/1984). Maximizing pleasure and minimizing displeasure have long been held to be basic human motives. Introspectionist psychologists (Titchener, 1910; Wundt, 1912/1924) thought of pleasure as an irreducible fundamental component of human emotion. And, of course, there was Freud's pleasure principle (in Strachey, 1974). In

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[1] These general instructions are part of the price of a single-item scale. We strongly recommend against giving subjects the Affect Grid without first giving them these general instructions. Following this recommendation will help ensure that results from different researchers are genuinely comparable.

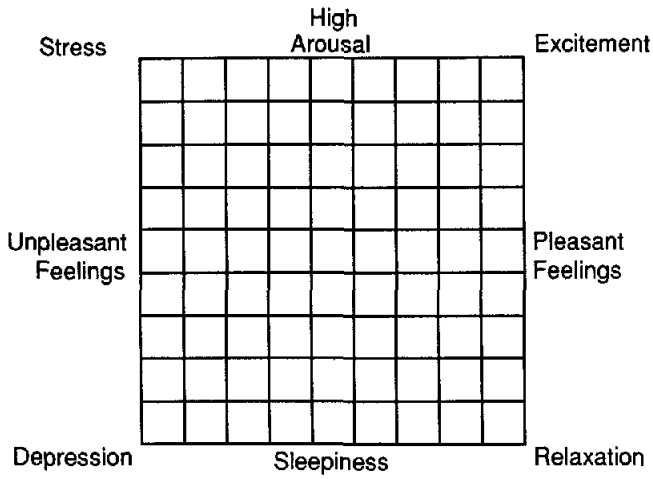

Figure 1. The Affect Grid. (The subject first reads the general instructions [given in the Appendix] and then is given specific instructions, such as "Please rate how you are feeling right now." The subject places one checkmark somewhere in the grid. The pleasure–displeasure (P) score is taken as the number of the square checked, with squares numbered along the horizontal dimension, counting 1 to 9 starting at the left. The arousal–sleepiness (A) score is taken as the number of the square checked, with squares numbered along the vertical dimension, counting 1 to 9 starting at the bottom.)

more modern psychology, the concept has emerged in varied contexts. Pleasure, evaluation, or positivity has appeared as the primary factor in studies of the meaning of concepts in general (Osgood, Suci, & Tannenbaum, 1957) and affective concepts in particular (Bush, 1973; Neufeld, 1975; J. A. Russell, 1978, 1980), in studies of the perception of nonverbal emotional signals (Dittmann, 1972; Emde, Kligman, Reich, & Wade, 1978; Frijda, 1969; Mehrabian, 1972; Osgood, 1966; J. A. Russell & Steiger, 1982; Schlosberg, 1954), and in self-reports of current affective state (J. A. Russell, 1979, 1980).

The concept of arousal is of more recent origin, although it too can be traced back at least as far as Wundt's (1912/1924) introspections, which resulted in his proposing the dimension of tension–relaxation. Arousal, activity, or activation has appeared as a major factor in all those studies in modern psychology cited in the previous paragraph as demonstrating a pleasure–displeasure factor. Within psychology, the word *arousal* has also been used to refer to a dimension of physiological activity (Duffy, 1957; Lindsley, 1951). Although the arousal dimension we are referring to may be based on and highly correlated with physiological activity, we consider any such relationship an empirical matter and emphasize that *arousal* here refers to a dimension of reported subjective feeling.

Pleasure and arousal are here considered to be dimensions, that is to say, continua; we take this to be self-evident. Further, pleasure is here considered to be the bipolar opposite of displeasure, and arousal to be the bipolar opposite of sleepiness (for supporting evidence, see J. A. Russell, 1979). Finally, pleasure–displeasure is here considered orthogonal to (i.e., independent of) arousal–sleepiness. By this we mean that the two are conceptually separate, even if they happen to be correlated positively or negatively in specific circumstances. Much of the evidence already cited is consistent with this assumption; it was directly tested and supported by J. A. Russell and Pratt (1980).

Watson and Tellegen (1985) recently proclaimed a consensus on a two-dimensional structure of affect. They noted, as we did, the convergence of different kinds of evidence: "In these studies Pleasantness–Unpleasantness . . . and degree of Arousal or Activation . . . have consistently, although not invariably, emerged as the two major dimensions" (p. 219). They then reanalyzed those studies on self-reported mood that had appeared to be at variance with this consensus and, again, obtained a two-dimensional structure. Their proposed model for that structure was said to be *descriptively bipolar,* with pleasantness–unpleasantness orthogonal to a dimension they termed *engagement* (aroused, astonished, surprised) versus *disengagement* (quiescent, quiet, still).

Watson and Tellegen (1985) also observed that many affect terms fall midway between these two dimensions. Rotating the traditional axes 45° produced two alternative dimensions, which they labeled *positive affect* and *negative affect.* Although these labels might suggest a conflict between Watson and Tellegen's model of affect and that which we are assuming in this article, Watson and Tellegen (1985) emphasized "the basic compatibility of the structures defined by these two alternative rotations" (p. 222). Mayer and Gaschke (1988) recently offered empirical evidence on this claim.

Earlier, J. A. Russell and Pratt (1980) had described the dimensions obtained by the same 45° rotation of the pleasure and arousal axes as, respectively, *excitement* versus *depression* and *stress* versus *relaxation.* They developed scales for the end points of these dimensions as well as for pleasantness–unpleasantness and arousal–sleepiness in the context of affective qualities attributed to environmental stimuli. The result was eight marker scales evenly spaced around the perimeter of the two-dimensional affect space. Those familiar with the idea of a circumplex will think of a related but fuller interpretation of affect space. Quite different sources of evidence have led to the idea that affect descriptors fall in a more or less continuous circular order around the edges of affect space (Plutchik, 1980; J. A. Russell, 1980; J. A. Russell & Bullock, 1985; Schlosberg, 1952). From a circumplex point of view, any rotation of the axes is possible because the structure of affect is determined by the circular ordering.

In short, few psychologists would doubt that the dimensions of pleasure–displeasure and arousal–sleepiness, or some rotation of them or structure containing them, are part of the description of affect. Still, many may be surprised at how much of the information contained in self-reports of affective state can be summarized with these two dimensions. J. A. Russell and Mehrabian (1977) showed that most of the reliable variance in 42 commonly used self-report affect scales, most purporting to assess discrete categories of emotion, could be predicted from scores on pleasure–displeasure, arousal–sleepiness, and dominance–submissiveness (with the last dimension accounting for only a small fraction of the variance) plus a method factor. J. A. Russell and Steiger (1982) showed that scores on McNair, Lorr, and Droppleman's (1971) Profile of Mood States could be predicted in a similar way.

There are other grounds for preferring an assessment technique based on orthogonal bipolar dimensions over one based on discrete categories of emotions (J. A. Russell, in press). Cate-

gory scales lack an effective way of dealing with feelings that do not fall into one of the a priori categories. Categorical measures also tend to be correlated with one another: For example, the three scales of Zuckerman and Lubin's (1965) Multiple Affect Adjective Checklist are named as discrete emotional categories but are, in fact, highly intercorrelated; estimates range between .67 and .90 (J. A. Russell, in press). These intercorrelations present the researcher with problems of interpretation analogous to the problems that result from any confounded variables.

On several grounds, then, we believe that a psychologist who is interested in assessing affect can often do so using a measure of pleasure and arousal. Further, there are grounds for constructing and using an instrument that assesses pleasure and arousal simultaneously. Focusing on either one alone runs the risk of confounding one dimension with the other. This may happen, as we shall discuss later, in the typical mood-induction study that seeks to compare the effects of a positive mood with those of a negative mood. For example, the mood of happy subjects is probably more aroused as well as more pleasant than is the mood of sad subjects. Similarly, Thayer's (1967, 1970, 1978) attempts to construct a measure of arousal alone resulted in scales that are correlated with pleasure–displeasure (Poortinga, Schadee, & Schadee, 1978; J. A. Russell, 1979).

Development of the Affect Grid

We developed the Affect Grid and its instructions through pilot testing. We first developed a single-item scale for assessing pleasure–displeasure and then a separate single-item scale for assessing arousal–sleepiness. We used a 9-place scale because work with the 7-place semantic-differential format showed that subjects can use at least 7 places but may avoid the extremes; 9 places allow subjects to avoid the extremes and still have enough room to make finely graded judgments (see Nunnally, 1967, p. 521). As we shall describe shortly, preliminary tests suggested that these instruments were adequate. Thus encouraged, we combined the two dimensions so that a single response would indicate both pleasure and arousal. Our new instrument had a circular format, based on the idea of a circular structure of emotions. Subjects placed their response within a set of concentric circles, somewhat like a dart board. Next, we developed a grid format, which was easier to score and easier to explain to subjects. By expanding the general instructions, we finally arrived at the Affect Grid as given in the Appendix and Figure 1.

Psychometric Properties

How trustworthy are scores from the Affect Grid? Item analysis and assessment of internal consistency are, of course, impossible with a single-item scale. Assessment of the reliability of the Affect Grid must, therefore, be done indirectly. Here, we report three studies in which we asked subjects to use the Affect Grid to rate external stimuli. These studies allowed an assessment of interjudge reliability. Also, by obtaining ratings of the same stimuli on other scales purporting to measure the same dimensions, we were able to calculate measures of convergent and discriminant validity. Because reliability sets an upper bound on validity, we can conversely say that an index of convergent validity estimates a lower bound on reliability.

When the Affect Grid is used for self-reports of current mood, its reliability is especially difficult to estimate directly because (a) assessment of interjudge reliability would require that a second judge have access to the subject's mental state, which is impossible, and (b) a test–retest estimate of reliability, although possible, would be inappropriate for any scale, including the Affect Grid, that measures states that can change quickly. Estimates of reliability obtained from ratings of external stimuli, as obtained in the first three studies, may not tell us how reliable the Affect Grid is when used to assess mood. In a fourth study, we, therefore, asked subjects to describe their current mood by means of the Affect Grid as well as two other affect scales. In this way, we were able to assess its convergent, discriminant, and predictive validity. We later turn to additional studies that have used the Affect Grid to test hypotheses concerning mood and that, therefore, speak to the question of construct validity.

In three of the four studies we report, the Affect Grid is compared with Mehrabian and Russell's (1974) measures of pleasure and arousal. These scales each consist of six items in a 9-place semantic-differential format. They have been used widely and successfully as measures of pleasure and arousal. For example, J. A. Russell, Ward, and Pratt (1981) report coefficient alpha estimates of their reliability as .91 and .81 respectively, for a sample of 323 subjects. For additional psychometric data on these scales, see Mehrabian and Russell (1974), J. A. Russell and Mehrabian (1977), and J. A. Russell and Steiger (1982).

Study 1: Group Ratings of Emotion-Related Words

In this study, 20 University of California undergraduates used the Affect Grid to assess the meaning of 28 emotion-related words (taken from J. A. Russell, 1980). Our concern was with the psychometric properties of the resulting scale values for the words.

First, the sample was randomly divided in half. Within each half sample, mean pleasure and arousal scores were calculated for each word. Calculated across the 28 words, the correlation between the two sets of P scores was .98 and that between the two sets of A scores was .97. Mean scores derived from the Affect Grid thus appear to be highly reliable.[2]

Second, using means from the full sample ($N = 20$), we estimated convergent and discriminant validity of the Affect Grid pleasure and arousal scores. We used data gathered with the preliminary scales mentioned earlier: 20 subjects had been asked to use the separate single-item pleasure and the single-item arousal scales to assess the meaning of the same 28 words. Another 20 subjects had been asked to use the circular format of the combined pleasure and arousal scale for the same task. Correlations between the scores derived from the three different methods are shown in Table 1. The coefficients shown above the diagonal are estimates of convergent validity and were encouragingly high. The coefficients shown below the diagonal are also interesting. As estimates of discriminant validity, they were encouragingly low: Although all were positive, none was signifi-

[2] We repeated this procedure with a nonoverlapping set of 41 emotion-related words. Fifty University of California undergraduates provided all the data. The estimate of split-half reliability ($n = 25$ in each half) was .98 for pleasure and .97 for arousal.

Table 1
Intercorrelations Among Three Scales of Pleasure and Arousal in Assessing Emotion-Related Words

Scale	1	2	3	4	5	6
Pleasure scales						
1. Single-item format	—	.93	.95			
2. Circular format		—	.89			
3. Affect Grid			—			
Arousal scales						
4. Single-item format	.04	.01	.03	—	.95	.95
5. Circular format	.17	.11	.05		—	.95
6. Affect Grid	.12	.08	.02			—

Note. Correlations were calculated between mean ratings and across 28 emotion-related words. Correlations given above the diagonal were hypothesized to be high; all were significant at $\alpha = .001$. Those below the diagonal were hypothesized to be close to zero; none was significantly different from zero at $\alpha = .05$.

cantly so, and none exceeded .20, even when format was identical. Furthermore, this result is consistent with our claim that pleasure and arousal are orthogonal. In short, we found surprisingly little indication here of method variance among these scales and much indication of specific reliable content variance. Of course, these three methods were only slightly different. Next we will examine convergent validity when the methods were more varied.

The same 28 words had previously been scaled (J. A. Russell, 1980) in three different ways thought to assess pleasure and arousal directly or indirectly: (a) In *direct circular scaling,* subjects were asked to place each of the 28 words in one of eight categories labeled by terms approximately 45° apart around the perimeter of our circular model of affect. From these judgments, coordinates were derived on the pleasure and arousal dimensions assumed to underlie the circular ordering. (b) In *multidimensional scaling,* subjects were asked to judge the pairwise similarity for the 28 words. These judgments were analyzed to yield coordinates on the first two resulting dimensions, which were interpretable as pleasure and arousal. (c) In *unidimensional scaling,* subjects were asked to rate each word for its meaning on Mehrabian and Russell's (1974) semantic-differential scales of pleasure–displeasure and arousal–sleepiness. Unlike the first two techniques, in which no dimension concept was imposed by the experimenter, this third technique was a more direct measurement of pleasure and arousal, and was, thus, more comparable to the methods used to yield the results of Table 1. Table 2 shows the pairwise correlations, each calculated across the 28 words, between scores obtained with the various techniques. The numbers above the diagonal give further evidence of the convergent validity of the Affect Grid; those below give further evidence of discriminant validity and of the orthogonality of pleasure and arousal.

Study 2: Group Ratings of Facial Expressions of Emotion

In this study, 20 facial expressions were scaled in much the same manner as had been words in Study 1. Again, the purpose was to examine the correlations between scale values obtained from the Affect Grid with scale values obtained from other measures of pleasure and arousal in order to estimate psychometric properties of the Affect Grid.

Twenty-five University of California undergraduates used the Affect Grid to assess the feeling expressed in each of 20 photographs of faces. The stimuli were 3 in. (7.62 cm) × 5 in. (12.70 cm) black-and-white photographs of frontal views of faces. Thirteen of the photos were taken from Ekman and Friesen's (1976) set entitled "Pictures of Facial Affect." These showed one neutral expression and two each of prototypical expressions of happiness, surprise, fear, anger, disgust, and sadness. The remaining seven were taken from James A. Russell's collection and represent feelings such as calmness, sleepiness, excitement, and boredom (see J. A. Russell & Bullock, 1985).

First, the sample was randomly divided in half (*ns* = 12 and 13) and separate mean pleasure and arousal scores were calculated for each picture in each half sample. The split-half reliability estimated in this way was .99 for pleasure and .97 for arousal.

Second, another 26 University of California undergraduates were given our preliminary separate single-item pleasure and arousal scales to assess the feeling expressed in each of the same 20 faces. Mean pleasure and arousal scores from these ratings were then correlated with scores obtained with the Affect Grid. The results, shown in Table 3, replicated the pattern of convergent and discriminant validity seen in Study 1.

Study 3: Individual Ratings of Facial Expressions

Often we are interested not in group means as the principal target of analysis but in the scores of an individual subject. Assessments done in clinical settings, in some repeated measures or longitudinal research designs, and in idiographic research

Table 2
Intercorrelations Among Four Scales of Pleasure and Arousal

Scale	1	2	3	4	5	6	7	8
Pleasure scales								
1. Direct circular scaling	—	.96	.97	.95				
2. Multidimensional scaling		—	.97	.96				
3. Unidimensional scaling			—	.96				
4. Affect Grid				—				
Arousal scales								
5. Direct circular scaling	−.12	−.28	−.20	−.23	—	.95	.95	.91
6. Multidimensional scaling	.09	−.07	.03	−.01		—	.95	.93
7. Unidimensional scaling	.10	−.05	.03	−.02			—	.95
8. Affect Grid	.16	.01	.07	.02				—

Note. Correlations were calculated between scale values and across 28 emotion-related words. Correlations given above the diagonal were hypothesized to be high; all were significant at $\alpha = .001$. Those below the diagonal were hypothesized to be close to zero; none was significantly different from zero at $\alpha = .05$.

Table 3
Intercorrelations Between Two Scales of Pleasure and Arousal in Assessing Facial Expressions of Emotion

Scale	1	2	3	4
Pleasure scales				
1. Affect Grid	—	.94		
2. Single-item		—		
Arousal scales				
3. Affect Grid	.11	.16	—	.95
4. Single-item	−.08	.11		—

Note. Correlations were calculated across mean scale values for 20 facial expressions of emotion. Correlations given above the diagonal were hypothesized to be high; those below the diagonal were hypothesized to be low.

are examples. Individual scores are apt to be less reliable than are group means, but few researchers report any relevant evidence for their scales. In fact, in a cursory review of the psychological literature, we found but a single report of an estimate of the reliability of individual affect scores. This observation was reported previously (J. A. Russell & Steiger, 1982), and no one has yet challenged the statement. The one exception to our statement was, in fact, data reported in the Russell and Steiger article.

Nine University of British Columbia undergraduates were asked to assess the feelings expressed in each of 27 photographs of facial expressions of emotion. Subjects used two scales to record their assessment: first the Affect Grid and then Mehrabian and Russell's (1974) semantic-differential type scales of pleasure and arousal. The set of photographs was a slightly enlarged version of those used in Study 2. With each subject rating the photographs with two separate scales of pleasure and of arousal, we could calculate correlations between the different ratings for each individual subject, yielding estimates of convergent validity and hence reliability. For the pleasure dimension, the resulting correlations ranged from .74 to .94. For the arousal dimension, the range was .63 to .92. Not surprisingly, some individuals are more reliable than others, but the average subject yielded scores sufficiently reliable to be useful: The median correlations are shown in Table 4.

Table 4
Median Intercorrelations Between Two Scales of Pleasure and Arousal in Assessing Facial Expressions of Emotion

Scale	1	2	3	4
Pleasure scales				
1. Affect Grid	—	.85		
2. Mehrabian & Russell (1974)		—		
Arousal scales				
3. Affect Grid	.06	.15	—	.81
4. Mehrabian & Russell (1974)	−.11	−.10		—

Note. Figures shown are median ($N = 9$) correlations with each correlation calculated across 27 facial expressions. Correlations above the diagonal were hypothesized to be high; those below the diagonal were hypothesized to be low.

Table 5
Descriptive Statistics for Three Mood Scales

Scale	*M*	*SD*
Affect Grid		
Pleasure	5.96	1.72
Arousal	4.99	1.86
Mehrabian & Russell (1974) scales		
Pleasure	5.79	1.44
Arousal	4.60	1.35
PANAS		
Positive affect	26.73	6.90
Negative affect	13.68	4.18

Note. $N = 162$. The Mehrabian & Russell (1974) scales were linearly transformed to have a potential range of 1 to 9, thus making them more readily comparable to the Affect Grid. The Watson, Clark, & Tellegen (1988) Positive and Negative Affect Schedule (PANAS) scales each have a potential range of 10 to 50.

Study 4: Mood

In this study, we examined the Affect Grid when used to gather self-reports of current mood. We included two other mood scales in order to examine the Affect Grid's convergent, discriminant, and predictive validity: Mehrabian and Russell's (1974) scales of pleasure and arousal and Watson, Clark, and Tellegen's (1988) Positive and Negative Affect Schedule (PANAS). The PANAS was developed to assess the Watson and Tellegen (1985) structure of affect, a 45° rotation of the pleasure–arousal space. It consists of two scales: Positive Affect (PA) and Negative Affect (NA), each with 10 items. The response format provides five alternatives, labeled *very slightly or not at all, a little, moderately, quite a bit,* and *extremely.* For psychometric data on these scales, see Watson, Clark, and Tellegen (1988).

Undergraduates at the University of British Columbia ($N = 162$) described their current mood (how they felt "right now") with the three instruments in the following order: (a) the Affect Grid, (b) the Mehrabian and Russell (1974) scales, and (c) the PANAS. Means and standard deviations for the three scales in this sample are given in Table 5.

Results for the Affect Grid. The top section of Table 6 gives correlations of the Affect Grid with the Mehrabian and Russell (1974) scales. As in previous tables, above the diagonal are estimates of convergent validity (and hence of lower bounds on reliability); below the diagonal are estimates of discriminant validity. The two figures above the diagonal were adequate, but lower than those obtained in the first three studies. Part of the reason may be that the correlations here were based on individual scores, some of which, as seen in Study 3, may be less reliable than others. In addition, many students in the classroom were relatively neutral on both dimensions, whereas the first three studies emphasized stimuli with more extreme values on one or both dimensions. Finally, ratings of mood may generally be less reliable than ratings of external stimuli.

The .77 and .80 numbers represent the ability of the Affect Grid to predict scores on the Mehrabian and Russell (1974) scales. Both numbers compare favorably to comparable ones on the ability of the PANAS to predict the Mehrabian and Russell scales. Because the PANAS is based on a rotated variant of

Table 6
Intercorrelations Between Two Scales of Pleasure and Arousal Plus the Positive and Negative Affect Schedule (PANAS) in Assessing Current Mood

Scale	1	2	3	4	5
Pleasure scales					
1. Affect Grid	—	.77			
2. Mehrabian & Russell (1974)		—			
Arousal scales					
3. Affect Grid	.14	.23	—	.80	
4. Mehrabian & Russell (1974)	.26	.35		—	
PANAS					
5. Positive Affect	.37	.47	.54	.65	—
6. Negative Affect	−.45	−.48	.11	.05	.05

Note. Correlations were calculated across 162 individuals. For the top section of the table, correlations given above the diagonal were hypothesized to be high (both were significant at alpha = .001), and those below the diagonal were hypothesized to be low, although all were significantly greater than zero at alpha = .05.

the pleasure–arousal space, multiple regression was used to estimate the maximum correlations. Together, the two PANAS scales were able to predict the Mehrabian and Russell pleasure scale with a multiple correlation of .70 and to predict the Mehrabian and Russell arousal scale with a multiple correlation of .65. Both of these numbers are significant at alpha = .01 and indicate substantial predictive power. At the same time, both are lower than corresponding figures from the Affect Grid.

We can also use PANAS as the criterion against which we can compare the predictive power of the Affect Grid with that of the Mehrabian and Russell (1974) scales. With PA as the criterion, the Affect Grid produced a multiple correlation of .62, the Mehrabian and Russell scales .70. With NA as the criterion, the Affect Grid produced a multiple correlation of .48, the Mehrabian and Russell scales .54. The absolute magnitudes of these numbers are difficult to interpret, but it is the relative magnitudes that are of interest here: In each comparison, the Affect Grid and the Mehrabian and Russell scales produced similar estimates of predictive power, but with the latter slightly more powerful, suggesting that the Mehrabian and Russell scales are slightly more reliable measures of mood than the Affect Grid.

The top section of Table 6 provides, below the diagonal, estimates of discriminant validity. All the numbers were sufficiently low to establish discriminant validity, but they also showed a small positive correlation between pleasure and arousal. Because the positive correlation occurred across response formats and because pleasure and arousal scales were essentially uncorrelated in other contexts, the most plausible interpretation of these numbers is not that the Affect Grid confounds the two but that pleasure and arousal indeed correlate, to a small degree, in the domain of mood, at least in this population.

PANAS. The data from this study provide an opportunity to examine the newly introduced PANAS. Table 5 shows that the mean for NA was very low and that its standard deviation was less than that for PA. The normative figures given for NA by Watson, Clark, and Tellegen (1988, Table 1, Moment time instructions) were a mean of 14.8 and a standard deviation of 5.4. The potential range of the scale is 10 to 50. In the present sample, the distribution of NA scores was positively skewed, 1.35. Coefficient alpha estimates of reliability were .87 for PA and .79 for NA.

The bottom half of Table 6 gives the correlations of PA and NA with the pleasure and arousal scales and with each other. PA and NA were uncorrelated, which would seem to say that positive affect is uncorrelated with (rather than the bipolar opposite of) negative affect. From this, it is a small step to saying that pleasure must be uncorrelated with (rather than the bipolar opposite of) displeasure. Actually, the low correlation between PA and NA was entirely expected, and the problem lies solely in the labels *positive affect* and *negative affect*. These labels seem to suggest that the PA and NA scales are measures of pleasure and displeasure, but, as we indicated earlier, the concepts of positive affect and negative affect on which the PANAS is based are not the same as pleasure and displeasure. And in fact, the correlations in Table 6 show that PA and NA cannot be equated with pleasure and displeasure: PA and NA correlated with the two pleasure–displeasure scales in the expected directions, but only moderately. Theoretically, PA is a measure of the combination of pleasure and arousal; NA is a measure of the combination of displeasure and arousal.

What was surprising was that this theoretical prediction was not borne out. The results of this study were not what would be expected if PA and NA were measures of dimensions at 45° in the pleasure–arousal space, at least when that space is operationally defined by either of the pleasure and arousal measures used here. The expected relationship would be that PA correlates positively and equally with both pleasure and arousal, and that NA correlates negatively with pleasure and positively with arousal, but again with both correlations equal in magnitude. Contrary to hypothesis, PA and NA were not equally correlated with arousal, and NA's correlation with arousal was negligible in size. Further, the difficulty is not simply a matter of rotation. The previously given multiple correlations expressing the relationship between the PANAS and the Affect Grid and between the PANAS and the Mehrabian and Russell (1974) scales indicated that although the overlap was significant and large, it did not include all the reliable variance.

Only further data can tell us whether this puzzling lack of convergence is limited to the present study or is a more reliable phenomenon. If it is reliable, there are at least three possible explanations: (a) PANAS is an imperfect measure of the Watson and Tellegen (1985) model of affect, (b) the Affect Grid and the Mehrabian and Russell (1974) scales are imperfect measures of the pleasure–arousal space, and (c) the Watson and Tellegen model is not simply the rotational variant of the pleasure–arousal space it had been assumed to be (J. A. Russell, 1983; Watson & Tellegen, 1985). And of course the final answer could be some combination of all three.

Some Uses of the Affect Grid

We now turn to studies that have used the Affect Grid to test predictions about mood. To the extent that scores on the Affect Grid vary in the way pleasure and arousal are theoretically predicted to vary, we have the beginnings of evidence on the construct validity of those scores.

Snodgrass, Russell, and Ward (1988) used the Affect Grid in an experimental test of a hypothesis inspired by Mandler's (1984) writings on emotion. According to Mandler, a discrepancy (such as that between expectation and reality or between plan and behavior) is arousing. If the discrepancy is satisfactorily resolved, the arousal combines with and intensifies the resulting pleasant feelings. If the discrepancy cannot be resolved, the arousal combines with and intensifies the resulting unpleasant feelings. The Affect Grid, yielding as it does independent measures of pleasure and arousal, was suited to explore these hypotheses. The study concerned the effects of a resolved discrepancy. Subjects were asked to plan their performance in a simulated espionage caper. Control subjects carried out their plans as expected. Experimental subjects were placed in a new situation, where they had to change their plans quickly. All subjects eventually succeeded at the task. Mood was assessed just after subjects had planned their strategy and again just after succeeding at the task. At the first assessment, up to which time both groups had been treated alike, no differences between groups were found. At the second assessment, the mood of the control subjects had remained virtually unchanged, whereas the mood of the experimental subjects had changed in the predicted way: Their level of both pleasure and arousal had risen.

The Affect Grid was used as a manipulation check in a mood induction study (J. A. Russell & Alden, 1987). At the beginning of the experiment, the subjects averaged slightly above neutral on both dimensions, 5.8 on P and 5.4 on A. Twenty-five subjects were asked to put themselves in a happy mood by listening to happy music and thinking happy thoughts; within 25 min, 20 of these subjects had reached the criterion of successful induction, a P score of 8 or 9. Twenty-four subjects were asked to put themselves in a sad mood through an analogous procedure; within 25 min, 20 of these subjects had reached a criterion P score of 1 or 2. Obviously the Affect Grid scores changed as anticipated. The 20 subjects in each condition who had reached criterion, along with another 20 control subjects, continued in the experiment by performing various rating tasks. A re-administration of the Affect Grid at the end of the experiment provided another and more subtle manipulation check. The twenty happy-induction subjects scored 6.2 on P, the sad-induction subjects scored 3.6 on P, and the control group scored 5.9 on P. These differences were statistically significant, $F(2, 57) = 20.74$, $p < .001$. Interestingly and expectably, the different induction procedures also resulted in differences in arousal. The happy-induction group was more aroused (A = 5.4) than was the sad-induction group (A = 3.5). This difference too was significant, $F(1, 38) = 15.33$, $p < .001$, and raises an interesting issue of interpretation of the results of mood induction studies.

Eich and Metcalfe (1989) used a slightly modified version of the Affect Grid as a manipulation check in four studies on the effects of mood. They found differences on both the pleasure and the arousal dimensions in subjects put through a musical mood-induction procedure—differences similar to those found by J. A. Russell and Alden (1987) and described earlier.

The next two studies to be reported highlight the advantages of an instrument that subjects are willing to use repeatedly. In a study on the physiology of fear, Forth and Hare (1987) asked phobic and nonphobic subjects to rate how they felt while viewing each of 60 slides. Spider-phobic subjects reported significantly more arousal and significantly less pleasure while seeing slides of spiders than while seeing other slides; nonphobic subjects reported no such difference.

In a study on mood cycles, McFarlane, Martin, and Williams (1988) asked 42 college men and women to make mood ratings daily for two months, and afterwards to try to remember what their mood had been at various times throughout that period. In all, over 3,000 Affect Grids were filled out. Two aspects of their study are of interest here. First, across the 3,000 forms, pleasure correlated with arousal a modest .25—confirming the results of our present Study 4. Second, subjects did not object to using the Affect Grid repeatedly; in fact, all were willing to extend the study. Incidentally, women's retrospective estimates of mood corresponded to the currently popular notion of a premenstrual syndrome, but their actual daily ratings did not. This result raises the possibility that reports of premenstrual blues are an artifact of selective memory.

Concluding Remarks

Researchers seeking a simple means to assess the dimensions of pleasure–displeasure and arousal–sleepiness should consider the Affect Grid. The Affect Grid showed strong evidence of convergent validity with other measures of pleasure and arousal, even when response format varied. The Affect Grid showed strong evidence of discriminant validity between the dimensions of pleasure and arousal, even when response format was identical. Aggregated affective judgments gathered with the Affect Grid appeared surprisingly reliable. That the Affect Grid is a single-item scale reinforces Burisch's (1984) argument that shorter scales are not always poorer scales.

Although only one of the four studies presenting the psychometric properties of the Affect Grid was concerned with self-rated mood, five additional studies by various investigators have used the Affect Grid to assess mood. The evidence of construct validity provided by those studies, together with the psychometric evidence we presented, justifies the use of the Affect Grid in the assessment of mood.

On the other hand, the Affect Grid is not an all-purpose scale. It appears slightly less reliable than a multiple-item questionnaire for self-reported mood. When the researcher's focus is on the individual subject and when time is available, a multiple-item questionnaire should be used if possible. Because of its lengthy instructions (see Appendix), the Affect Grid would be no less time consuming for a single administration than would be a multiple-item scale. The Affect Grid is also an undisguised measure and should probably be thought of as a means of quantifying what subjects want to tell the researcher concerning the dimensions of pleasure and arousal. When there is reason to doubt that what the subjects want to tell you coincides with what they actually think or feel, then another kind of measurement device may be called for.

The Affect Grid may prove to be the instrument of choice when subjects are called on to make affective judgments in rapid succession or to make a large number of judgments, especially when those judgments are to be aggregated. Indeed, appropriately implemented on a computer, the Affect Grid should prove capable of assessing the continuous flux of affective response to drama, music, personal interaction, and the like.

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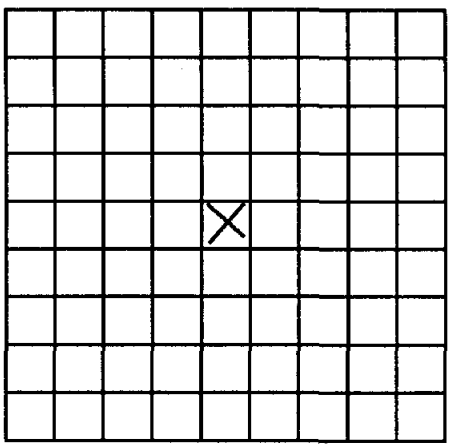
Appendix

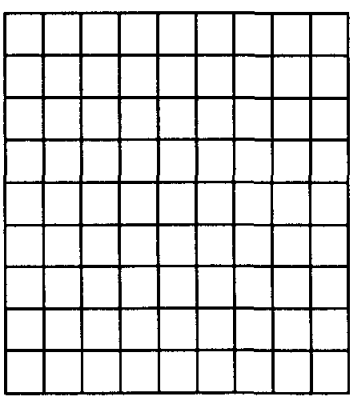
The Affect Grid

You use the "affect grid" to describe feelings. It is in the form of a square—a kind of map for feelings. The center of the square (marked by X in the grid below) represents a neutral, average, everyday feeling. It is neither positive nor negative.



The right half of the grid represents pleasant feelings. The farther to the right the more pleasant. The left half represents unpleasant feelings. The farther to the left, the more unpleasant.

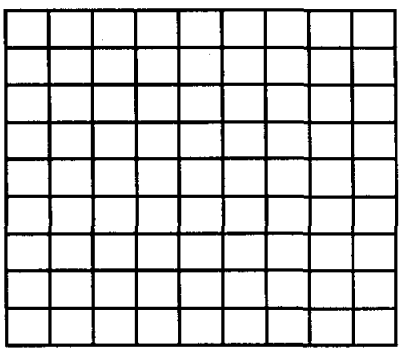
EXTREMELY UNPLEASANT FEELINGS



EXTREMELY PLEASANT FEELINGS

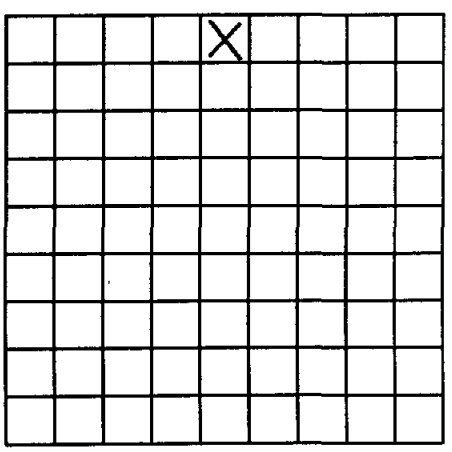
The vertical dimension of the map represents degree of arousal. Arousal has to do with how wide awake, alert, or activated a person feels—independent of whether the feeling is positive or negative. The top half is for feelings that are above average in arousal. The lower half for feelings below average. The bottom represents sleep, and the higher you go, the more awake a person feels. So, the next step up from the bottom would be half awake/half asleep. At the top of the square is maximum arousal. If you imagine a state we might call frantic excitement (remembering that it could be either positive or negative), then this feeling would define the top of the grid.

EXTREMELY HIGH AROUSAL



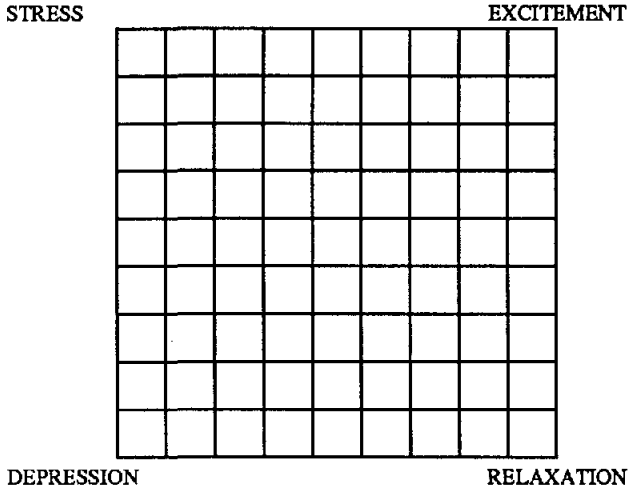
EXTREME SLEEPINESS

If the "frantic excitement" was positive it would, of course, fall on the right half of the grid. The more positive, the farther to the right. If the "frantic excitement" was negative, it would fall on the left half of the grid. The more negative, the farther to the left. If the "frantic excitement" was neither positive nor negative, then it would fall in the middle square of the top row, as shown below.



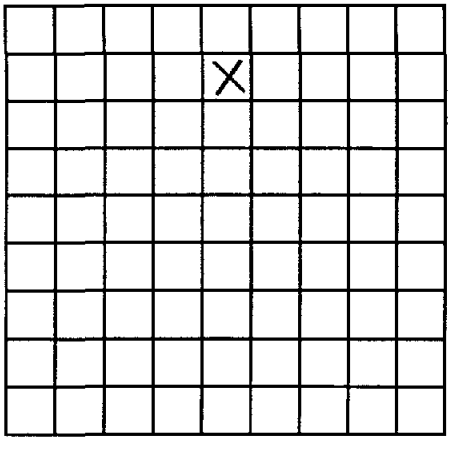
Other areas of the grid can be labeled as well. Up and to the right are feelings of ecstasy, excitement, joy. Opposite these, down and to the left, are feelings of depression, melancholy, sadness, and gloom.

Up and to the left are feelings of stress and tension. Opposite these, down and to the right, are feelings of calm, relaxation, serenity.

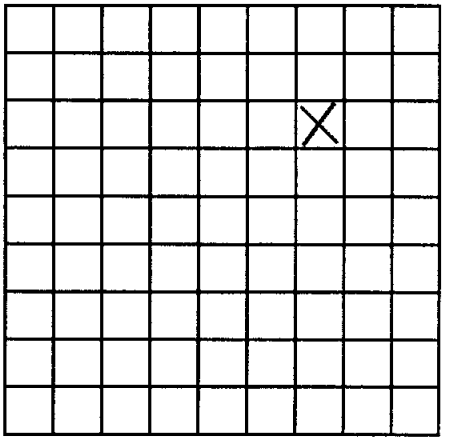


Feelings are complex. They come in all shades and degrees. The labels we have given are merely landmarks to help you understand the affect grid. When actually using the grid, put an X anywhere in the grid to indicate the exact shade and intensity of feeling. Please look over the entire grid to get a feel for the meaning of the various areas.

EXAMPLE: Suppose that you were just surprised. Suppose further that the surprise was neither pleasant nor unpleasant. Probably you would feel more aroused than average. You might put your mark as shown.



EXAMPLE: Suppose, instead, that you were only mildly surprised but that the surprise was a mildly pleasant one. You might put your mark as shown below.



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